with 10 dm^3 of liquid propylene and 2.5 standard 1 of hydrogen gas. 10 cm^3 of triisobutylaluminum (20% in hydrocarbon, 10 mmol) were then added to the reactor and the mixture was stirred at 30° C. for 15 minutes. The catalyst suspension was subsequently added to the reactor, heated to the polymerization temperature of 70° C. (4° C./min) and the polymerization system was kept at 70° C. for 1 hour by cooling. The polymerization gave 3200 g of isotactic polypropylene powder.

The catalyst activity was 320 kg of PP/(g of metallocenex h).

VN=164 cm^3/g, mp.=147° C., $MFI_{(230/2.16)}$=25 dg/min.

EXAMPLE 22

The preparation of the catalyst suspension of Example 10 was repeated, except that 2 mg (3.1 μmol) of rac-dimethylsilanediylbis(2-ethyl-4-phenyl-1-indenyl) zirconium(4-butadiene) dissolved in 5 cm^3 of toluene were reacted with 1.7 mg (3.3 μmol) of $B(C_6F_5)_3$ dissolved in 5 cm^3 of toluene. The polymerization gave 2150 g of isotactic polypropylene powder.

The catalyst activity was 1075 kg of PP/(g of metallocenexh).

VN=656 cm^3/g, mp.=162° C., $MFI_{(230/5)}$=0.8 dg/min, M_w=957,000 g/mol, M_w/M_n=3.0.

EXAMPLE 23

The preparation of the catalyst suspension of Example 10 was repeated, except that 2 mg (2.8 μmol) of rac-dimethylsilanediylbis(2-methyl-4-naphthyl-1-indenyl) zirconium(4-butadiene) dissolved in 5 cm^3 of toluene were reacted with 1.4 mg (2.8 μmol) of $B(C_6F_5)_3$ dissolved in 5 cm^3 of toluene. The polymerization gave 2500 g of isotactic polypropylene powder.

The catalyst activity was 1250 kg of PP/(g of metallocenexh).

VN=777 cm^3/g, mp.=163° C., $MFI_{(230/5)}$=0.5 dg/min, M_w=1,200,000 g/mol, M_w/M_n=3.2.

EXAMPLE 24

10 g of silica gel (Davison 948), which had been conditioned at 800° C., were admixed with 0.5 g of $B(C_6F_5)_3$ dissolved in 15 cm^3 of toluene and homogenized. The solvent was taken off in vacuo. This resulted in a free-flowing powder. 200 mg of rac-dimethylsilanediylbis(2-methyl-1-indenyl)zirconium(4-butadiene) (435 μmol) were dissolved in 15 cm^3 of toluene and applied in small portions to the intensively stirred, free-flowing powder. The powder acquires an intense dark red color. The toluene was subsequently taken off in vacuo. This resulted in 11.3 g of supported catalyst as free-flowing powder. 1.5 g of the supported catalyst were suspended in 10 ml of hexane and introduced into the polymerization reactor. The polymerization was carried out by a method similar to Example A at 70° C. The excess monomer was drawn off and the polymer powder was dried in vacuo. This gave 2350 g of isotactic polypropylene powder having a bulk density of 0.44 g/ml and a mean particle size of the polymer particles of 650 μm. Analysis of the polymer gave VN=172 cm^3/g, mp.=145° C., M_w=192,000 g/mol, M_w/M_n=2.2, $MFI_{(230/2.16)}$=13 dg/min.

EXAMPLE 25

Comparative Example

The preparation of the catalyst suspension of Example 10 was repeated, except that 5 mg (11.1 μmol) of rac-dimethylsilanediylbis-1-indenylzirconium(η^4-butadiene) dissolved in 10 cm^3 of toluene were reacted with 5.7 mg (11.1 μmol) of $B(C_6F_5)_3$ dissolved in 10 cm^3 of toluene. The polymerization resulted in 2200 g of isotactic polypropylene powder.

The catalyst activity was 440 kg of PP/(g of metallocenex h).

VN=52 cm^3/g, mp.=140° C., M_w=49,000 g/mol, M_w/M_n=2.2.

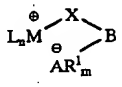
16.6 mg (40.7 μmol) of rac-dimethylsilanediylbis-1-indenylzirconiumdimethyl were dissolved in 10 cm^3 of toluene and reacted with 21 mg (41 μmol) of $B(C_6F_5)_3$ dissolved in 10 cm^3 of toluene. No turbidity or precipitate formation can be observed. The catalyst solution is used for the polymerization as in Example 9. This resulted in 130 g of isotactic polypropylene powder.

The catalyst activity was 8 kg of PP/g(g of metallocenex h).

VN=67 cm^3/g, mp.=139.5° C., M_w=62,000 g/mol, M_w/M_n=2.1.

We claim:

1. A zwitterionic transition metal compound of the formula I



(I)

where

L are identical or different and are each a π-ligand or an electron donor, n is equal to 1, 2, 3 or 4,

M is a metal atom of group IIIb, IVb, Vb or VIb of the Periodic Table of the Elements,

X is a heteroatom or a hydrocarbon group having 1–40 carbon atoms,

X' is a hydrocarbon group having 1–40 carbon atoms,

A is an atom of group Ib, IIb, IIIa, IIIb, IVa, Va, Vb, VIb, VIIb or VIIIb of the Periodic Table of the Elements,

R^1 are identical or different and are each a perhalogenated C_1–C_{40}-hydrocarbon radical, and m is equal to 1, 2, 3, 4 or 5.

2. A transition metal compound as claimed in claim 1, wherein the radicals L are identical or different and are each a π-ligand.

3. A transition metal compound as claimed in claim 1, wherein the radicals L are identical or different and are each an unsubstituted or substituted cyclopentadienyl group.

4. A transition metal compound as claimed in claim 1, wherein the radicals L are linked to one another via a bridge.

5. A transition metal compound as claimed in claim 1, wherein n=2 when M is a metal atom of group IVb of the Periodic Table of the Elements.

6. A transition metal compound as claimed in claim 1, wherein

M is a metal atom of group IVb of the Periodic Table of the Elements, n is equal to 2,

L are identical or different and are each a substituted or unsubstituted cyclopentadienyl group, where two radicals L are optionally linked to one another via a bridge Z and

Z is CR^2R^3 or SiR^2R^3 or a unit $Si—(CR^2R^3)_x—Si$ which links two fragments $L_nM^+XX'—A—R^1_m$ with one another, where x is an integer from 0 to 10,

X and X' together form a three-membered to five-membered hydrocarbon chain which can be saturated or unsaturated and are unsubstituted or substituted by one or more C_1–C_{20}-hydrocarbon radicals,

R^2 and R^3 are identical or different and are each a hydrogen atom, a halogen atom, a C_1–C_{20}-alkyl group, a C_1–C_{10}-fluoralkyl group, a C_1–C_{10}-alkoxy group, a C_6–C_{14}-aryl group, a C_6–C_{10}-fluoroaryl group, a C_6–C_{10}-aryloxy group, a C_2–C_{10}-alkenyl group, a C_7–C_{40}-arylalkyl group, a C_7–C_{40}-alkylaryl group, a C_8–C_{40}-arylalkenyl group, or R^2 and R^3 together with the atoms connected them form one or more rings, and R^2 and R^3 are optionally bonded to L;

A is an atom of group Ib, IIb, IIIa, IVa, Va, Vb of the Periodic Table of the Elements,

R^1 are identical or different and are each a perfluorinated alkyl or aryl group having from 1 to 20 carbon atoms and

m is equal to 2, 3 or 4.

7. A transition metal compound as claimed in claim 6, wherein

M is zirconium,

n is equal to 2,

L are identical or different and are each a substituted cyclopentadienyl group, where two radicals L are linked to one another via a bridge Z, where Z is CR^2R^3 or SiR^2R^3 and R^2 and R^3 are as defined in claim 6,

X and X' together form an unsaturated four-membered hydrocarbon chain whose hydrogen atoms are optionally replaced by C_1–C_{20}-alkyl groups,

A is boron atom,

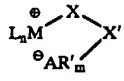
R^1 are identical and are each a pentafluorophenyl group (C_6F_5) and

m is equal to 3.

8. A catalyst component comprising at least one transition metal compound as claimed in claim 1.

9. A catalyst component as claimed in claim 8, additionally containing a support.

10. A process for preparing a compound according to claim 1 of the formula I,



(I)

where

L are identical or different and are each a π ligand or an electron donor, n is equal to 1, 2, 3 or 4,

M is a metal atom of group IIIb, IVb, Vb or VIb of the Periodic Table of the Elements,

X is a heteroatom or a hydrocarbon group having 1–40 carbon atoms,

X' is a hydrocarbon group having 1–40 carbon atoms,

A is an atom of group Ib, IIb, IIIa, IIIb, IVa, Va, Vb, VIb, VIIb or VIIIb of the Periodic Table of the Elements,

R^1 are identical or different and are each a perhalogenated C_1–C_{40}-hydrocarbon radical, and m is equal to 1, 2, 3, 4 or 5, which comprises reacting a compound of the formula II

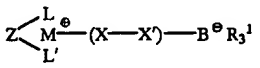
II

with a compound of the formula III

III

and reacting the reaction product with a compound of the formula AR^1_m, where L, n, M, X, B, A, R^1 and m in the formulae II, III and AR^1_m are as defined for the formula I and Hal is a halogen atom.

11. A zwiterionic transition metal compound of the formula



wherein:

L and L' are identical or different and are each a substituted or unsubstituted cyclopentadienyl group;

Z is a bridge linking together said L and L' and is a group of the formula CR^2R^3 or SiR^2R^3;

R^2 and R^3 are identical or different and are each a hydrogen atom, a halogen atom, a C_1–C_{20}-alkyl group, a C_1–C_{10}-fluoralkyl group, a C_1–C_{10}-alkoxy group, a C_6–C_{14}-aryl group, a C_6–C_{10}-fluoroaryl group, a C_6–C_{10}-aryloxy group, a C_2–C_{10}-alkenyl group, a C_7–C_{40}-arylalkyl group, a C_7–C_{40}-alkylaryl group, a C_8–C_{40}-arylalkenyl group, or R^2 and R^3 together with the atoms connected them form one or more rings, and R^2 and R^3 are optionally bonded to L;

M is a metal atom of group IVb of the Periodic Table of the Elements;

X–X' is a 3- to 5-membered saturated or unsaturated hydrocarbon chain which is unsubstituted or substituted by one or more C_1–C_{20}-hydrocarbon radicals; and

the R^1 radicals are identical or different and are each a perfluorinated alkyl or aryl group having from 1 to 20 carbon atoms.

12. A catalyst system for olefin polymerization comprising a transition metal compound of claim 11 and, optionally, a catalyst support material.

13. A catalyst system as claimed in claim 12, wherein said catalyst system is essentially free of an aluminoxane except when said catalyst support material is present and is a solid aluminoxane.

14. The catalyst as claimed in claim 8, wherein M is titanium, zirconium or hafnium.

15. The catalyst as claimed in claim 12, wherein M is zirconium.

16. The catalyst as claimed in claim 14, wherein an unsubstituted or

M is Zr,

n is equal to 2,

L are identical or different and are each a substituted cyclopentadienyl group, where two radicals L are linked to one another via a bridge Z, and

Z is CR^2R^3 or SiR^2R^3 or a unit Si—$(CR^2R^3)_x$—Si which links two fragments $L_nM^+XX'A$—R^1_m with one another, where x is an integer from 0 to 10,

X and X' together form a three-membered to five-membered (C_3–C_5)-alkyl chain which is saturated or unsaturated and optionally substituted by C_1–C_{20}-hydrocarbon radicals,

A is a metal of group Ib, IIb, IIIb, IVa, Vb, of the Periodic Table of the Elements,

R^1 are identical or different and are each a pentafluorinated alkyl or aryl group having from 1 to 20 carbon atoms,

R^2 and R^3 are identical or different and are each a hydrogen atom, a halogen atom, a C_1–C_{20}-alkyl group, a C_1–C_{10}-fluoralkyl group, a C_1–C_{10}-alkoxy group, a C_6–C_{14}-aryl group, a C_6–C_{10}-fluoroaryl group, a C_6–C_{10}-aryloxy group, a C_2–C_{10}-alkenyl group, a C_7–C_{40}-arylalkyl group, a C_7–C_{40}-alkylaryl group, a C_8–C_{40}-arylalkenyl group and

m is equal to 3.

17. The catalyst as claimed in claim 8, wherein

M is zirconium,

n is equal to 2,

L are identical or different and are each a substituted cyclopentadienyl group, where two radicals L are bonded to one another via a bridge Z, where Z is CR^2R^3 or SiR^2R^3,

X and X' together form an unsaturated four-membered (C_4)-alkyl chain whose hydrogen atoms can also be replaced by C_1–C_{20}-alkyl groups,

A is a boron atom,

R^1 are identical and are each a pentafluorophenyl group (C_6F_5),

R^2 and R^3 are identical or different and are each a hydrogen atom, a halogen atom, a C_1–C_{20}-alkyl group, a C_1–C_{10}-fluoralkyl group, a C_1–C_{10}-alkoxy group, a C_6–C_{14}-aryl group, a C_6–C_{10}-fluoroaryl group, a C_6–C_{10}-aryloxy group, a C_2–C_{10}-alkenyl group, a C_7–C_{40}-arylalkyl group, a C_7–C_{40}-alkylaryl group, a C_8–C_{40}-arylalkenyl group and m is equal to 3.

18. The compound as claimed in claim 1, wherein the transition metal compound of the formula I is selected from the group consisting of

bis(cyclopentadienyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;

bis(methylcyclopentadienyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;

bis(n-butylcyclopentadienyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;

bisindenyl$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;

(tert-butylamido)dimethyl(tetramethyl-η^5-cyclopentadienyl)silane$Zr^{+CH}{}_2CHCHCH_2B^-(C_6F_5)_3$;

bis(2-methylbenzoindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;

dimethylsilanediylbis(2-methylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;

dimethylsilanediylbisindenyl$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;

dimethylsilanediylbis(2-methylbenzoindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;

dimethylsilanediyl(2-methylbenzoindenyl)(2-methylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;

dimethylsilanediyl(2-methylbenzoindenyl)(2-methyl-4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;

dimethylsilanediyl(2-methylindenyl)(4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;

dimethylsilanediylbis(2-methyl-4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;

dimethylsilanediylbis(2-methyl-4,6-diisopropylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;

dimethylsilanediylbis(2-methylindenyl)$Zr^+CH_2CHCHCH_2B^-(CF_3)_3$;

dimethylsilanediylbisindenyl$Zr^+CH_2CHCHCH_2B^-(CF_3)_3$;

dimethylsilanediylbis(2-methylbenzoindenyl)$Zr^+CH_2CHCHCH_2B^-(CF_3)_3$;

dimethylsilanediyl(2-methylbenzoindenyl)(2-methylindenyl)$Zr^+CH_2CHCHCH_2B^-(CF_3)_3$;

dimethylsilanediyl(2-methylbenzoindenyl)(2-methyl-4-phenylindenyl)$Zr^+CH_2CHCHCH_2CH_2B^-(CF_3)_3$;

dimethylsilanediyl(2-methylindenyl)(4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(CF_3)_3$;

dimethylsilanediylbis(2-methyl-4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(CF_3)_3$;

dimethylsilanediylbis(2-methyl-4,6-diisopropylindenyl)$Zr^+CH_2CHCHCH_2B^-(CF_3)_3$;

dimethylsilanediylbis(2-methyl-4-naphthylindenyl)$Zr^+CH_2CHCHCH_2B^-(CF_3)_3$;

dimethylsilanediylbis(2-methylindenyl)$Zr^+CH_2C(CH_3)C(CH_3)CH_2B^-(CF_3)_3$;

dimethylsilanediylbisindenyl$Zr^+CH_2C(CH_3)C(CH_3)CH_2B^-(CF_3)_3$;

dimethylsilanediylbis(2-methylbenzoindenyl)$Zr^+CH_2C(CH_3)C(CH_3)CH_2B^-(CF_3)_3$;

dimethylsilanediyl(2-methylbenzoindenyl)(2-methylindenyl)$Zr^+CH_2C(CH_3)C(CH_3)CH_2B^-(CF_3)_3$;

dimethylsilanediyl(2-methylbenzoindenyl)(2-methyl-4-phenylindenyl)$Zr^+CH_2C(CH_3)C(CH_3)CH_2B^-(CF_3)_3$;

dimethylsilanediyl(2-methylindenyl)(4-phenylindenyl)$Zr^+CH_2C(CH_3)C(CH_3)CH_2B^-(CF_3)_3$;

dimethylsilanediylbis(2-methyl-4-phenylindenyl)$Zr^+CH_2C(CH_3)C(CH_3)CH_2B^-(CF_3)_3$;

dimethylsilanediylbis(2-methyl-4,6-diisopropylindenyl)$Zr^+CH_2C(CH_3)C(CH_3)C_2B^-(CF_3)_3$;

dimethylsilanediylbis(2-methyl-4-naphthylindenyl)$Zr^+CH_2C(CH_3)C(CH_3)CH_2B^-(CF_3)_3$;

methylphenylmethylene(fluorenyl)(cyclopentadienyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;

diphenylmethylene(fluorenyl)(cyclopentadienyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;

isopropylidene(3-methylcyclopentadienyl)(fluorenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;

dimethylsilanediyl(3-tert-butylcyclopentadienyl)(fluorenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;

diphenylsilanediyl(3-(trimethylsilyl)cyclopentadienyl)(fluorenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;

phenylmethylsilanediylbis(2-methylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;

phenylmethylsilanediylbisindenyl$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;

isopropylidene(cyclopentadienyl)(fluorenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;

isopropylidene(cyclopentadienyl)(indenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;

[4-η^5-cyclopentadienyl-4,7,7-trimethyl-(η^5-4,5,6,7-tetrahydroindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;

dimethylsilanediylbis(2-methylindenyl)$Zr^+OCH_2CH_2CH_2B^-(C_6F_5)_3$;

dimethylsilanediylbisindenyl$Zr^+OCH_2CH_2CH_2B^-(C_6F_5)_3$;

dimethylsilanediylbis(2-methylbenzoindenyl)$Zr^+OCH_2CH_2CH_2B^-(C_6F_5)_3$;

dimethylsilanediyl(2-methylbenzoindenyl)(2-methylindenyl)$Zr^+OCH_2CH_2CH_2B^-(C_6F_5)_3$;

dimethylsilanediyl(2-methylbenzoindenyl)(2-methyl-4-phenylindenyl)$Zr^+OCH_2CH_2CH_2B^-(C_6F_5)_3$;

dimethylsilanediyl(2-methylindenyl)(4-phenylindenyl)$Zr^+OCH_2CH_2CH_2B^-(C_6F_5)_3$;

dimethylsilanediylbis(2-methyl-4-phenylindenyl)$Zr^+OCH_2CH_2CH_2B^-(C_6F_5)_3$;

dimethylsilanediylbis(2-methyl-4,6-diisopropylindenyl)$Zr^+OCH_2CH_2CH_2B^-(C_6F_5)_3$;

dimethylsilanediylbis(2-methylindenyl)$Zr^+CH_2CHCHCH_2B^-(CF_3)_3$;

dimethylsilanediylbisindenyl$Zr^+CH_2CHCHCH_2B^-(CF_3)_3$;

dimethylsilanediylbis(2-methylbenzoindenyl)$Zr^+CH_2CHCHCH_2B^-(CF_3)_3$;

dimethylsilanediyl(2-methylbenzoindenyl)(2-methylindenyl)$Zr^+CH_2CHCHCH_2B^-(CF_3)_3$;

dimethylsilanediyl(2-methylbenzoindenyl)(2-methyl-4-phenylindenyl)$Zr^+CH_2CHCHCH_2CH_2B^-(CF_3)_3$;

dimethylsilanediyl(2-methylindenyl)(4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(CF_3)_3$;

dimethylsilanediylbis(2-methyl-4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(CF_3)_3$;

dimethylsilanediylbis(2-methyl-4,6-diisopropylindenyl)$Zr^+CH_2CHCHCH_2B^-(CF_3)_3$;

dimethylsilanediylbis(2-methyl-4-naphthylindenyl)$Zr^+CH_2CHCHCH_2B^-(CF_3)_3$;

methylphenylmethylene(fluorenyl)(cyclopentadienyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;

diphenylmethylene(fluorenyl)(cyclopentadienyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;

isopropylidene(3-methylcyclopentadienyl)(fluorenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;

dimethylsilanediyl(3-tert-butylcyclopentadienyl)(fluorenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;

diphenylsilanediyl(3-(trimethylsilyl)cyclopentadienyl)(fluorenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;

phenylmethylsilanediylbis(2-methylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;

phenylmethylsilanediylbisindenyl$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;

phenylmethylsilanediylbis(2-methyl-4,5-benzoindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
phenylmethylsilanediyl(2-methyl-4,5-benzoindenyl)(2-methylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
phenylmethylsilanediyl(2-methyl-4,5-benzoindenyl)(2-methyl-4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
phenylmethylsilanediyl(2-methylindenyl)(4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
phenylmethylsilanediylbis(2-methyl-4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
phenylmethylsilanediylbis(2-ethyl-4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
phenylmethylsilanediylbis(2-methyl-4,6-diisopropylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
phenylmethylsilanediylbis(2-methyl-4-naphthylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
ethylenebis(2-methylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
ethylenebisindenyl$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
ethylenebis(2-methyl-4,5-benzoindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
ethylene(2-methyl-4,5-benzoindenyl)(2-methylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
ethylene(2-methyl-4,5-benzoindenyl)(2-methyl-4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
ethylene(2-methylindenyl)(4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
ethylenebis(2-methyl-4,5-benzoindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
ethylenebis(2-methyl-4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
ethylenebis(2-methyl-4,6-diisopropylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
ethylenebis(2-methyl-4-naphthylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
ethylenebis(2-ethyl-4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
ethylenebis(2-ethyl-4,6-diisopropylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
ethylenebis(2-ethyl-4-naphthylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
dimethylsilanediylbis(2-ethyl-4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
dimethylsilanediylbis(2,3,5-trimethylcyclopentadienyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
1,6-{bis[methylsilylbis(2-methyl-4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$]}hexane;
1,6-{bis[methylsilylbis(2-ethyl-4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$]}hexane;
1,6-{bis[methylsilylbis(2-methyl-4-naphthylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$]}hexane;
1,6-{bis[methylsilylbis(2-methyl-4,5-benzoindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$]}hexane;
1,6-{bis[methylsilyl(2-methyl-4-phenylindenyl)(2-methylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$]}hexane;
1,2-{bis[methylsilylbis(2-methyl-4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$]}ethane;
1,2-{bis[methylsilylbis(2-ethyl-4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$]}ethane;
1,2-{bis[methylsilylbis(2-methyl-4-naphthylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$]}ethane;
1,2-{bis[methylsilylbis(2-methyl-4,5-benzoindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$]}ethane; and
1,2-{bis[methylsilyl(2-methyl-4-phenylindenyl)(2-methylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$]}ethane.

19. The catalyst as claimed in claim 8, wherein the transition metal compound of the formula I is selected from the group consisting of

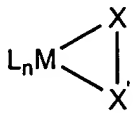
bis(cyclopentadienyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
bis(methylcyclopentadienyl)$Zr^+C_2CHCHCH_2B^-(C_6F_5)_3$;
bis(n-butylcyclopentadienyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
bisindenyl$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
(tert-butylamido)dimethyl(tetramethyl-η^5-cyclopentadienyl)silane$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
bis(2-methylbenzoindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
dimethylsilanediylbis(2-methylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
dimethylsilanediylbisindenyl$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
dimethylsilanediylbis(2-methylbenzoindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
dimethylsilanediyl(2-methylbenzoindenyl)(2-methylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
dimethylsilanediyl(2-methylbenzoindenyl)(2-methyl-4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
dimethylsilanediyl(2-methylindenyl)(4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
dimethylsilanediylbis(2-methyl-4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
dimethylsilanediylbis(2-methyl-4,6-diisopropylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
dimethylsilanediylbis(2-methylbenzoindenyl)$Zr^+CH_2CHCHCH_2B^-(CF_3)_3$;
dimethylsilanediyl(2-methylbenzoindenyl)(2-methylindenyl)$Zr^+CH_2CHCHCH_2B^-(CF_3)_3$;
dimethylsilanediyl(2-methylbenzoindenyl)(2-methyl-4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(CF_3)_3$;
dimethylsilanediyl(2-methylindenyl)(4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(CF_3)_3$;
dimethylsilanediylbis(2-methyl-4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(CF_3)_3$;
dimethylsilanediylbis(2-methyl-4,6-diisopropylindenyl)$Zr^+CH_2CHCHCH_2B^-(CF_3)_3$;
dimethylsilanediylbis(2-methyl-4-naphthylindenyl)$Zr^+CH_2CHCHCH_2B^-(CF_3)_3$;
dimethylsilanediylbis(2-methylindenyl)$Zr^+CH_2C(CH_3)C(CH_3)CH_2B^-(CF_3)_3$;
dimethylsilanediylbisindenyl$Zr^+CH_2C(CH_3)C(CH_3)CH_2B^-(CF_3)_3$;
dimethylsilanediylbis(2-methylbenzoindenyl)$Zr^+CH_2C(CH_3)C(CH_3)CH_2B^-(CF_3)_3$;
dimethylsilanediyl(2-methylbenzoindenyl)(2-methylindenyl)$Zr^+CH_2C(CH_3)C(CH_3)CH_2B^-(CF_3)_3$;
dimethylsilanediyl(2-methylbenzoindenyl)(2-methyl-4-phenylindenyl)$Zr^+CH_2C(CH_3)C(CH_3)CH_2B^-(CF_3)_3$;
dimethylsilanediyl(2-methylindenyl)(4-phenylindenyl)$Zr^+CH_2C(CH_3)C(CH_3)CH_2B^-(CF_3)_3$;
dimethylsilanediylbis(2-methyl-4-naphthylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
isopropylidene(cyclopentadienyl)(fluorenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
isopropylidene(cyclopentadienyl)(indenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
[4-η^5-cyclopentadienyl-4,7,7-trimethyl-(η^5-4,5,6,7-tetrahydroindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
dimethylsilanediylbis(2-methylindenyl)$Zr^+OCH_2CH_2CH_2B^-(C_6F_5)_3$;
dimethylsilanediylbisindenyl$Zr^+OCH_2CH_2C_2B^-(C_6F_5)_3$;
dimethylsilanediylbis(2-methylbenzoindenyl)$Zr^+OCH_2CH_2CH_2B^-(C_6F_5)_3$;
dimethylsilanediyl(2-methylbenzoindenyl)(2-methylindenyl)$Zr^+OCH_2CH_2CH_2B^-(C_6F_5)_3$;
dimethylsilanediyl(2-methylbenzoindenyl)(2-methyl-4-phenylindenyl)$Zr^+OCH_2CH_2CH_2B^-(C_6F_5)_3$;
dimethylsilanediyl(2-methylindenyl)(4-phenylindenyl)$Zr^+OCH_2CH_2CH_2B^-(C_6F_5)_3$;

dimethylsilanediylbis(2-methyl-4-phenylindenyl)$Zr^+OCH_2CH_2CH_2B^-(C_6F_5)_3$;
dimethylsilanediylbis(2-methyl-4,6-diisopropylindenyl)$Zr^+OCH_2CH_2CH_2B^-(C_6F_5)_3$;
dimethylsilanediylbis(2-methylindenyl)$Zr^+CH_2CHCHCH_2B^-(CF_3)_3$;
dimethylsilanediylbisindenyl$Zr^+CH_2CHCHCH_2B^-(CF_3)_3$;
dimethylsilanediylbis(2-methyl-4-phenylindenyl)$Zr^+CH_2C(CH_3)C(CH_3)CH_2B^-(CF_3)_3$;
dimethylsilanediylbis(2-methyl-4,6-diisopropylindenyl)$Zr^+CH_2C(CH_3)C(CH_3)CH_2B^-(CF_3)_3$;
dimethylsilanediylbis(2-methyl-4-naphthylindenyl)$Zr^+CH_2C(CH_3)C(CH_3)CH_2B^-(CF_3)_3$;
methylphenylmethylene(fluorenyl)(cyclopentadienyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
diphenylmethylene(fluorenyl)(cyclopentadienyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
isopropylidene(3-methylcyclopentadienyl)(fluorenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
dimethylsilanediyl(3-tert-butylcyclopentadienyl)(fluorenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
diphenylsilanediyl(3-(trimethylsilyl)cyclopentadienyl)(fluorenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
phenylmethylsilanediylbis(2-methylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
phenylmethylsilanediylbisindenyl$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
phenylmethylsilanediylbis(2-methyl-4,5-benzoindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
phenylmethylsilanediyl(2-methyl-4,5-benzoindenyl)(2-methylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
phenylmethylsilanediyl(2-methyl-4,5-benzoindenyl)(2-methyl-4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
phenylmethylsilanediyl(2-methylindenyl)(4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
phenylmethylsilanediylbis(2-methyl-4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
phenylmethylsilanediylbis(2-ethyl-4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
phenylmethylsilanediylbis(2-methyl-4,6-diisopropylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
phenylmethylsilanediylbis(2-methyl-4-naphthylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
ethylenebis(2-methylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
ethylenebisindenyl$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
ethylenebis(2-methyl-4,5-benzoindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
ethylene(2-methyl-4,5-benzoindenyl)(2-methylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
ethylene(2-methyl-4,5-benzoindenyl)(2-methyl-4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
ethylene(2-methylindenyl)(4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
ethylenebis(2-methyl-4,5-benzoindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
ethylenebis(2-methyl-4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
ethylenebis(2-methyl-4,6-diisopropylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
ethylenebis(2-methyl-4-naphthylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
ethylenebis(2-ethyl-4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
ethylenebis(2-ethyl-4,6-diisopropylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
ethylenebis(2-ethyl-4-naphthylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
dimethylsilanediylbis(2-ethyl-4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
dimethylsilanediylbis(2,3,5-trimethylcyclopentadienyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$;
1,6-{bis[methylsilylbis(2-methyl-4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$]}hexane;
1,6-{bis[methylsilylbis(2-ethyl-4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$]}hexane;
1,6-{bis[methylsilylbis(2-methyl-4-naphthylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$]}hexane;
1,6-{bis[methylsilylbis(2-methyl-4,5-benzoindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$]}hexane;
1,6-{bis[methylsilyl(2-methyl-4-phenylindenyl)(2-methylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$]}hexane;
1,2-{bis[methylsilylbis(2-methyl-4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$]}ethane;
1,2-{bis[methylsilylbis(2-ethyl-4-phenylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$]}ethane;
1,2-{bis[methylsilylbis(2-methyl-4-naphthylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$]}ethane;
1,2-{bis[methylsilylbis(2-methyl-4,5-benzoindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$]}ethane; and
1,2-{bis[methylsilyl(2-methyl-4-phenylindenyl)(2-methylindenyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$]}ethane.

20. The compound as claimed in claim **1**, wherein M is zirconium.

21. The compound as claimed in claim **1**, wherein M is a metal atom group IVb of the Periodic Table of Elements.

22. A transition metal compound of the formula IV



(IV)

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wherein

L are identical or different and are each a substituted π ligand,

n is equal to 1, 2, 3, or 4,

M is a metal atom of group IIIb, IVb, Vb or VIb of the Periodic Table of the Elements,

X is a heteroatom or a hydrocarbon group having 1-40 carbon atoms,

X' is a hydrocarbon group having 1-40 carbon atoms.

23. The transition metal compound as claimed in claim 22, wherein the radicals L are identical or different and are each a substituted cyclopentadienyl group.

24. The transition metal compound as claimed in claim 22, wherein the radicals L are linked to one another via a bridge.

25. The transition metal compound as claimed in claim 22, wherein n is 2 when M is a metal atom of group IVb of the Periodic Table of the Elements.

26. The transition metal compound as claimed in claim 22, wherein

M is a metal atom of group IVb of the Periodic Table of the Elements, n is equal to 2,

L are identical or different and are each a substituted cyclopentadienyl group, where two radicals L are optionally linked to one another via a bridge Z and

Z is CR^2R^3 or SiR^2R^3 or a unit $Si-(CR^2R^3)_x-Si$ which links two fragments $L_nMXX'A-R^1_m$ with one another, where x is an integer from 0 to 10,

X and X' together form a three-membered to five-membered hydrocarbon chain which can be saturated or unsaturated and are unsubstituted or substituted by one or more C_1-C_{20}-hydrocarbon radicals,

R^2 and R^3 are identical or different and are each a hydrogen atom, a halogen atom, a C_1-C_{20}-alkyl group, a C_1-C_{10}-fluoralkyl group, a C_1-C_{10}-alkoxy group, a C_6-C_{14}-aryl group, a C_6-C_{10}-fluoroaryl group, a C_6-C_{10}-aryloxy group, a C_2-C_{10}-alkenyl group, a C_7-C_{40}-arylalkyl group, a C_7-C_{40}-alkylaryl group, a C_8-C_{40}-arylalkenyl group, or R^2 and R^3 together with the atoms connected them form one or more rings, and R^2 and R^3 are optionally bonded to L.

27. The transition metal compound as claimed in claim 22, wherein

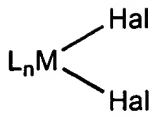
M is zirconium,

n is equal to 2,

L are identical or different and are each a substituted cyclopentadienyl group, where two radicals L are linked to one another via a bridge Z, where Z is CR^2R^3 or SiR^2R^3 and R^2 and R^3 are identical or different and are each a hydrogen atom, a halogen atom, a C_1-C_{20}-alkyl group, a C_1-C_{10}-fluoralkyl group, a C_1-C_{10}-alkoxy group, a C_6-C_{14}-aryl group, a C_6-C_{10}-fluoroaryl group, a C_6-C_{10}-aryloxy group, a C_2-C_{10}-alkenyl group, a C_7-C_{40}-arylalkyl group, a C_7-C_{40}-alkylaryl group, a C_8-C_{40}-arylalkenyl group, or R^2 and R^3 together with the atoms connected them form one or more rings, and R^2 and R^3 are optionally bonded to L,

X and X' together form an unsaturated four-membered hydrocarbon chain whose hydrogen atoms are optionally replaced by C_1-C_{20}-alkyl groups.

28. A process for preparing the compound as claimed in claim 22, which comprises reacting a compound of the formula II



(II)

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with a compound of the formula III

(III)

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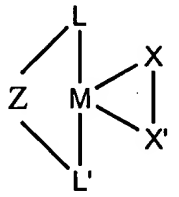
and reacting the reaction product with a compound of the formula AR^1_m, where L, n, M, X and X' in the formulae II and III are defined for the formula IV and Hal is a halogen atom.

29. A transition metal compound of the formula IV'



(IV')

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where

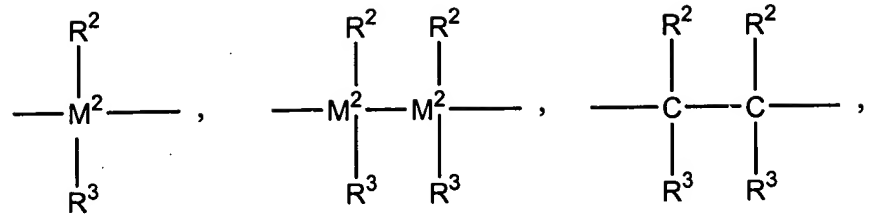
L and L' are identical or different and are each a π ligand or an electron donor,

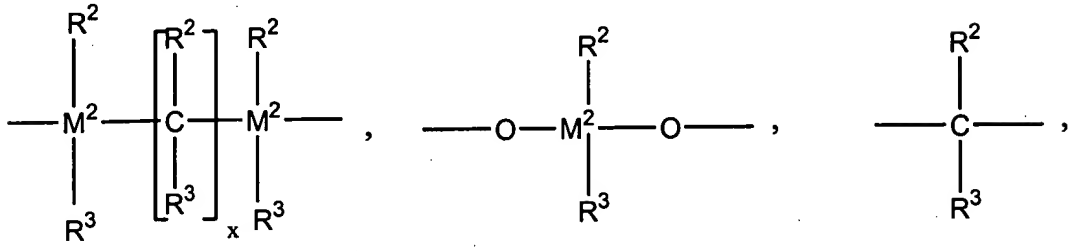
M is a metal atom of group IIIb, IVb, Vb or VIb of the Periodic Table of the Elements,

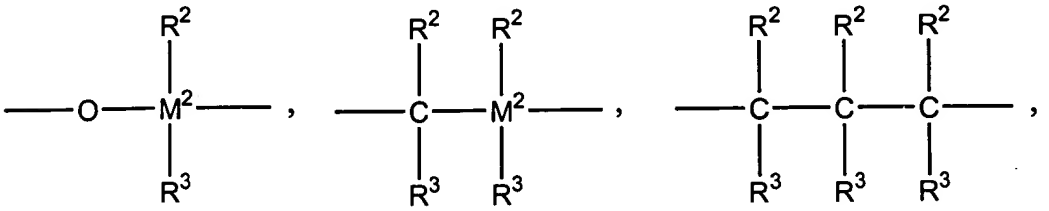
X is a heteroatom or a hydrocarbon group having 1-40 carbon atoms,

X' is a hydrocarbon group having 1-40 carbon atoms,

Z is







=BR_2, -AlR^2, -Ge-, -O-, -S-, =SO, =SO_2, -NR_2, =CO, =PR^2 or =$P(O)R^2$, where R^2 and R^3 are identical or different and are each a hydrogen atom, a halogen atom, a C_1-C_{20}-alkyl group, a C_1-C_1-fluoroalkyl group, a C_1-C_{10}-alkoxy group, a C_6-C_{14}-aryl group, a C_6-C_{10}-fluoroaryl group, a C_6-C_{10}-aryloxy group, a C_2-C_{10}-alkenyl group, a C_7-C_{40}-arylalkyl group, a C_7-C_{40}-alkylaryl group, a C_8-C_{40}-arylalkenyl group and x is a number from zero to 18, or R^2 and R^3 together with the atoms-connecting them form one or more rings and R^2 or/and R^3 can be bonded to L and M^2 is silicon, germanium or tin.

30. The transition metal compound as claimed in claim 29, wherein the radicals L are

identical or different and are each an unsubstituted or substituted cylclopentadienyl group.

31. The transition metal compound as claimed in claim 29, wherein the radicals L are linked to one another via a bridge.

32. The transition metal compound as claimed in claim 29, wherein n is 2 when M is a metal atom of group IVb of the Periodic Table of the Elements.

33. The transition metal compound as claimed in claim 29, wherein

M is a metal atom of group IVb of the Periodic Table of the Elements, n is equal to 2,

L are identical or different and are each a substituted or unsubstituted cyclopentadienyl group, where two radicals L are optionally linked to one another via a bridge Z and

Z is CR^2R^3 or SiR^2R^3 or a unit $Si\text{-}(CR^2R^3)_x\text{-}Si$ which links two fragments $L_uM^1XX'A\text{-}R^1_m$ with one another, where x is an integer from 0 to 10,

X and X' together form a three-membered to five-membered hydrocarbon chain which can be saturated or unsaturated and are unsubstituted or substituted by one or more C_1-C_{20}-hydrocarbon radicals,

R^2 and R^3 are identical or different and are each a hydrogen atom, a halogen atom, a C_1-C_{20}-alkyl group, a C_1-C_{10}-fluoralkyl group, a C_1-C_{10}-alkoxy group, a C_6-C_{14}-aryl group, a C_6-C_{10}-fluoroaryl group, a C_6-C_{10}-aryloxy group, a C_2-C_{10}-alkenyl group, a C_7-C_{40}-arylalkyl group, a C_7-C_{40}-alkylaryl group, a C_8-C_{40}-arylalkenyl group, or R^2 and R^3 together with the atoms connected them form one or more rings, and R^2 and R^3 are optionally bonded to L.

34. The transition metal compound as claimed in claim 29, wherein

M is zirconium,

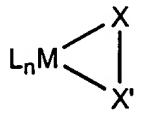
n is 2,

L are identical or different and are each a substituted cyclopentadienyl group, where two radicals L are linked to one another via a bridge Z, where Z is CR^2R^3 or SiR^2R^3,

R^2 and R^3 are identical or different and are each a hydrogen atom, a halogen atom, a C_1-C_{20}-alkyl group, a C_1-C_{10}-fluoralkyl group, a C_1-C_{10}-alkoxy group, a C_6-C_{14}-aryl group, a C_6-C_{10}-fluoroaryl group, a C_6-C_{10}-aryloxy group, a C_2-C_{10}-alkenyl group, a C_7-C_{40}-arylalkyl group, a C_7-C_{40}-alkylaryl group, a C_8-C_{40}-arylalkenyl group, or R^2 and R^3 together with the atoms connected them form one or more rings, and R^2 and R^3 are optionally bonded to L.

X and X' together form an unsaturated four-membered hydrocarbon chain whose hydrogen atoms are optionally replaced by C_1-C_{20}-alkyl groups.

35. A transition metal compound of the formula IV



(IV)

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wherein

L are different if n is 2, 3 or 4, and are each a π ligand or electron donor,

n is equal to 1, 2, 3, or 4,

M is a metal atom of group IIIb, IVb, Vb or VIb of the Periodic Table of the Elements,

X is a heteroatom or a hydrocarbon group having 1-40 carbon atoms,

X' is a hydrocarbon group having 1-40 carbon atoms.

36. The transition metal compound as claimed in claim 35, wherein the radicals L are different and are each an unsubstituted or substituted cylclopentadienyl group.

37. The transition metal compound as claimed in claim 35, wherein the radicals L are

linked to one another via a bridge.

38. The transition metal compound as claimed in claim 35, wherein n is 2 when M is a metal atom of group IVb of the Periodic Table of the Elements.

39. The transition metal compound as claimed in claim 35, wherein

M is a metal atom of group IVb of the Periodic Table of the Elements, n is equal to 2,

L are different and are each a substituted or unsubstituted cyclopentadienyl group, where two radicals L are optionally linked to one another via a bridge Z and

Z is CR^2R^3 or SiR^2R^3 or a unit $Si-(CR^2R^3)_x-Si$ which links two fragments $L_nM^tXX'A-R^1_m$ with one another, where x is an integer from 0 to 10,

X and X' together form a three-membered to five-membered hydrocarbon chain which can be saturated or unsaturated and are unsubstituted or substituted by one or more C_1-C_{20}-hydrocarbon radicals,

R^2 and R^3 are identical or different and are each a hydrogen atom, a halogen atom, a C_1-C_{20}-alkyl group, a C_1-C_{10}-fluoralkyl group, a C_1-C_{10}-alkoxy group, a C_6-C_{14}-aryl group, a C_6-C_{10}-fluoroaryl group, a C_6-C_{10}-aryloxy group, a C_2-C_{10}-alkenyl group, a C_7-C_{40}-arylalkyl group, a C_7-C_{40}-alkylaryl group, a C_8-C_{40}-arylalkenyl group, or R^2 and R^3 together with the atoms connected them form one or more rings, and R^2 and R^3 are optionally bonded to L.

40. The transition metal compound as claimed in claim 35, wherein

M is zirconium,

n is 2,

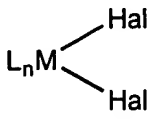
L are different and are each a substituted cyclopentadienyl group, where two radicals L are linked to one another via a bridge Z, where Z is CR^2R^3 or SiR^2R^3 and

R^2 and R^3 are identical or different and are each a hydrogen atom, a halogen atom, a C_1-C_{20}-

alkyl group, a C_1-C_{10}-fluoralkyl group, a C_1-C_{10}-alkoxy group, a C_6-C_{14}-aryl group, a C_6-C_{10}-fluoroaryl group, a C_6-C_{10}-aryloxy group, a C_2-C_{10}-alkenyl group, a C_7-C_{40}-arylalkyl group, a C_7-C_{40}-alkylaryl group, a C_8-C_{40}-arylalkenyl group, or R^2 and R^3 together with the atoms connected them form one or more rings, and R^2 and R^3 are optionally bonded to L.

X and X' together form an unsaturated four-membered hydrocarbon chain whose hydrogen atoms are optionally replaced by C_1-C_{20}-alkyl groups.

41. A process for preparing the compound as claimed in claim 35, which comprises reacting a compound of the formula II



(II)

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with a compound of the formula III

(III)

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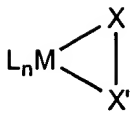
and reacting the reaction product with a compound of the formula AR^1_m, where L, n, M, X and X' in the formulae II and III are defined for the formula IV,

Hal is a halogen atom.

42. A transition metal compound of the formula IV



(IV)

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wherein

L are identical or different and are each a π ligand or electron donor,

n is equal to 1, 2, 3, or 4,

M is a metal atom of group IIIb, IVb, Vb or VIb of the Periodic Table of the Elements,

X is a heteroatom, a C_6-C_{14}-aryl group, a C_7-C_{40}-arylalkyl group, a C_7-C_{40}-alkylaryl group or a C_8-C_{40}-arylalkenyl group,

X' is a hydrocarbon group having 1-40 carbon atoms.

43. The transition metal compound as claimed in claim 42, wherein the radicals L are different and are each an unsubstituted or substituted cylclopentadienyl group.

44. The transition metal compound as claimed in claim 42, wherein the radicals L are linked to one another via a bridge.

45. The transition metal compound as claimed in claim 42, wherein n is 2 when M is a metal atom of group IVb of the Periodic Table of the Elements.

46. The transition metal compound as claimed in claim 42, wherein

M is a metal atom of group IVb of the Periodic Table of the Elements, n is equal to 2,

L are different and are each a substituted or unsubstituted cyclopentadienyl group, where two radicals L are optionally linked to one another via a bridge Z and

Z is CR^2R^3 or SiR^2R^3 or a unit Si-$(CR^2R^3)_x$-Si which links two fragments $L_uM'XX'A$-R^1_m with one another, where x is an integer from 0 to 10,

X and X' together form a three-membered or five-membered hydrocarbon chain which can be saturated or unsaturated and are unsubstituted or substituted by one or more C_1-C_{20}-hydrocarbon radicals,

R^2 and R^3 are identical or different and are each a hydrogen atom, a halogen atom, a C_1-C_{20}-alkyl group, a C_1-C_{10}-fluoralkyl group, a C_1-C_{10}-alkoxy group, a C_6-C_{14}-aryl group, a C_6-C_{10}-fluoroaryl group, a C_6-C_{10}-aryloxy group, a C_2-C_{10}-alkenyl group, a C_7-C_{40}-arylalkyl group, a C_7-C_{40}-alkylaryl group, a C_8-C_{40}-arylalkenyl group, or R^2 and R^3 together with the atoms connected them form one or more rings, and R^2 and R^3 are optionally bonded to L.

47. The transition metal compound as claimed in claim 42, wherein

M is zirconium,

n is 2,

L are different and are each a substituted cyclopentadienyl group, where two radicals L are linked to one another via a bridge Z, where Z is CR^2R^3 or SiR^2R^3 and

R^2 and R^3 are identical or different and are each a hydrogen atom, a halogen atom, a C_1-C_{20}-alkyl group, a C_1-C_{10}-fluoralkyl group, a C_1-C_{10}-alkoxy group, a C_6-C_{14}-aryl group, a C_6-C_{10}-fluoroaryl group, a C_6-C_{10}-aryloxy group, a C_2-C_{10}-alkenyl group, a C_7-C_{40}-arylalkyl group, a C_7-C_{40}-alkylaryl group, a C_8-C_{40}-arylalkenyl group, or R^2 and R^3 together with the atoms connected them form one or more rings, and R^2 and R^3 are optionally bonded to L.

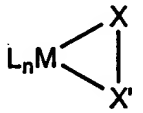
48. A compound selected from the group consisting of

Bis(methylcyclopentadienyl)$ZrCH_2CHCHCH_2$;
Bis(n-butyl-cyclopentadienyl)$ZrCH_2CHCHCH_2$;
Bisindenyl$ZrCH_2CHCHCH_2$;
(tert.butylamido)dimethyl(tetramethyl-η^5-cyclopentadienyl)silan-$Zr^+CH_2CHCHCH_2$;
Bis(2-methylbenzoindenyl)$ZrCH_2CHCHCH_2$;
Dimethylsilandiylbis(2-methyl-indenyl)$ZrCH_2CHCHCH_2$;
Dimethylsilandiylbisindenyl$Zr^+CH_2CHCHCH_2$;
Dimethylsilandiylbis(2-methylbenzoindenyl)$ZrCH_2CHCHCH_2$;
Dimethylsilandiyl(2-methylbenzoindenyl)(2-methyl-indenyl) $ZrCH_2CHCHCH_2$;
Dimethylsilandiyl(2-methylbenzoindenyl)(2-methyl-4-phenylindenyl) $ZrCH_2CHCHCH_2$;
Dimethylsilandiyl(2-methlindenyl)(4-phenylindenyl)$ZrCH_2CHCHCH_2$;
Dimethylsilandiylbis(2-methyl-4-phenyl-indenyl)$ZrCH_2CHCHCH_2$;
Dimethylsilandiylbis(2-methyl-4,6-diisopropyl-indenyl)Zr^+ $CH_2CHCHCH_2$;
Dimethylsilaniylbis(2-methyl-4-naphtyl-indenyl)$ZrCH_2CHCHCH_2$;
Isopropyliden(cyclopentadienyl)(fluorenyl)$ZrCH_2CHCHCH_2$;
Isopropyliden(cyclopentadienyl)(indenyl)$ZrCH_2CHCHCH_2$;
[4-(η^5-Cyclopentadienyl)-4,7,7-trimethyl-(η^5-4.5.6.7-tetrahydroindenyl)$ZrCH_2CHCHCH_2$;
Dimethylsilandiylbis(2-methyl-indenyl)$ZrOCH_2CH_2CH_2$;
Dimethylsilandiylbisindenyl$ZrOCH_2CH_2CH_2$;
Dimethylsilandiylbis(2-methylbenzoindenyl)$ZrOCH_2CH_2CH_2$;
Dimethylsilandiyl(2-methylbenzoindenyl)(2-methyl-indenyl) $ZrOCH_2CH_2CH_2$;
Dimethylsilandiyl(2-methylbenzoindenyl)(2-methyl-4-phenylindenyl) $ZrOCH_2CH_2CH_2$;
Dimethylsilandiyl(2-methlindenyl)(4-phenylindenyl)$ZrOCH_2CH_2CH_2$;
Dimethylsilandiylbis(2-methyl-4-phenyl-indenyl)$ZrOCH_2CH_2CH_2$;
Dimethylsilandiylbis(2-methyl-4,6-diisopropyl-indenyl) $ZrOCH_2CH_2CH_2$;
Dimethylsilandiylbis(2-methyl-indenyl)$ZrCH_2C(CH_3)C(CH_3)CH_2$;
Dimethylsilandiylbisindenyl$ZrCH_2C(CH_3)C(CH_3)CH_2$;
Dimethylsilandiylbis(2-methylbenzoindenyl)$Zr^+CH_2C(CH_3)C(CH_3)CH_2$;
Dimethylsilandiyl(2-methylbenzoindenyl)(2-methyl-indenyl) $ZrCH_2C(CH_3)C(CH_3)CH_2$;
Dimethylsilandiyl(2-methylbenzoindenyl)(2-methyl-4-phenylindenyl) $ZrCH_2C(CH_3)C(CH_3)CH_2$;

Dimethylsilandiyl(2-methlindenyl)(4-phenylindenyl)
$ZrCH_2C(CH_3)C(CH_3)CH_2$;
Dimethylsilandiylbis(2-methyl-4-phenyl-indenyl)
$ZrCH_2C(CH_3)C(CH_3)CH_2$;
Dimethylsilandiylbis(2-methyl-4,6-diisopropyl-indenyl)
$ZrCH_2C(CH_3)C(CH_3)CH_2$;
Dimethylsilaniylbis(2-methyl-4-naphtyl-indenyl)
$ZrCH_2C(CH_3)C(CH_3)CH_2$;
Methylphenylmethylen-(fluorenyl)(cyclopentadienyl)$ZrCH_2CHCHCH_2$;
Diphenylmethylen-(fluorenyl)(cyclopentadienyl)$ZrCH_2CHCHCH_2$;
Isopropyliden-(3-methylcyclopentadienyl)(fluorenyl)
$ZrCH_2CHCHCH_2B^-(C_6F_5)_3$;
Dimethylsilandiyl-(3-tert.-Butylcyclopentadienyl)(fluorenyl)
$ZrCH_2CHCHCH_2$;
Diphenylsilandiyl-(3-(trimethylsilyl)cyclopentadienyl)(fluorenyl)
$ZrCH_2CHCHCH_2$;
Phenylmethylsilandiylbis(e-methyl-indenyl)$ZrCH_2CHCHCH_2$;
Phenylmethylsilandiylbisindenyl$ZrCH_2CHCHCH_2$;
Phenylmethylsilandiylbis(2-methyl-4,5-benzoindenyl)$ZrCH_2CHCHCH_2$;
Phenylmethylsilandiylbis(2-methyl-4,5-benzoindenyl)(2-methyl
-indenyl)$ZrCH_2CHCHCH_2$
Phenylmethylsilandiyl(2-methyl-4,5-benzoindenyl)(2-methyl-4
-phenylindenyl)$ZrCH_2CHCHCH_2$;
Phenylmethylsilaniyl(2-methylindenyl)(4-phenylindenyl)
$ZrCH_2CHCHCH_2$;
Phenylmethylsilandiylbis(2-methyl-4-phenyl-indenyl)$ZrCH_2CHCHCH_2$;
Phenylmethylsilandiylbis(2-ethyl-4-phenyl-indenyl)$ZrCH_2CHCHCH_2$;
Phenylmethylsilandiylbis(2-methyl-4,6-diisopropyl-indenyl)
$ZrCH_2CHCHCH_2$;
Phenylmethylsilandiylbis(2-methyl-4-naphtyl-indenyl)$ZrCH_2CHCHCH_2$;
Ethylenbis(2-methyl-indenyl)$ZrCH_2CHCHCH_2$;
Ethylenbisindenyl$ZrCH_2CHCHCH_2$;
Ehtylenbis(2-methyl-4,5-benzoindenyl)$ZrCH_2CHCHCH_2$;
Ethylen(2-methyl-4,5-benzoindenyl)(2-methyl-indenyl)$ZrCH_2CHCHCH_2$;
Ethylen(2-methyl-4,5-benzoindenyl)(2-methyl-4-phenylindenyl)
$ZrCH_2CHCHCH_2$;
Ethylen(2-methylindenyl)(4-phenylindenyl)$ZrCH_2CHCHCH_2$;
Ethylenbis(2-methyl-4,5-benzoindenyl)$ZrCH_2CHCHCH_2$;
Ethylenbis(2-methyl-4-phenyl-indenyl)$ZrCH_2CHCHCH_2$;
Ethylenbis(2-methyl-4,6-diisopropyl-indenyl)$ZrCH_2CHCHCH_2$;

Ethylenbis(2-methyl-4-naphtyl-indenyl)$ZrCH_2CHCHCH_2$;
Ethylenbis(2-ethyl-4-phenyl-indenyl)$ZrCH_2CHCHCH_2$;
Ethylenbis(2-ethyl-4,6-diisopropyl-indenyl)$ZrCH_2CHCHCH_2$;
Ethylenbis(2-ethyl-4-naphtyl-indenyl)$ZrCH_2CHCHCH_2$;
Dimethylsilandiylbis(2-ethyl-4-phenyl-indenyl)$ZrCH_2CHCHCH_2$;
Dimethylsilandiylbis(2,3,5-trimethylcyclopentadienyl)
$ZrCH_2CHCHCH_2$;
1,6-{Bis[methylsilyl-bis(2-methyl-4-phenyl-indenyl)$Zr^+CH_2CHCHCH_2$
$B^-(C_6F_5)_3$]}hexan;
1,6-{Bis[methylsilyl-bis(2-ethyl-4-phenyl-indenyl)
$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$]}hexan;
1,6-{Bis[methylsilyl-bis(2-methyl-4-naphtyl-indenyl)$Zr^+CH_2CHCHCH_2$
$B^-(C_6F_5)_3$]}hexan;
1,6-{Bis[methylsilyl-bis(2-methyl-4,5-benzoindenyl)$Zr^+CH_2CHCHCH_2$
$B^-(C_6F_5)_3$]}hexan;
1,6-{Bis[methylsilyl-(2-methyl-4-phenyl-indenyl)(2-methyl-inde-
nyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$]}hexan;
1,2-{Bis[methylsilyl-bis(2-methyl-4-phenyl-indenyl)$Zr^+CH_2CHCHCH_2$
$B^-(C_6F_5)_3$]}ethan;
1,2-{Bis[methylsilyl-bis(2-ethyl-4-phenyl-indenyl)$Zr^+CH_2CHCHCH_2$
$B^-(C_6F_5)_3$]}ethan;
1,2-{Bis[methylsilyl-bis(2-methyl-4-naphtyl-indenyl)$Zr^+CH_2CHCHCH_2$
$B^-(C_6F_5)_3$]}ethan;
1,2-{Bis[methylsilyl-bis(2-methyl-4,5-benzoindenyl)$Zr^+CH_2CHCHCH_2$
$B^-(C_6F_5)_3$]}ethan;and
1,2-{Bis[methylsilyl-(2-methyl-4-phenyl-indenyl)(2-methyl-inde-
nyl)$Zr^+CH_2CHCHCH_2B^-(C_6F_5)_3$]}ethan.

49. A transition metal compound of the formula IV



(IV)

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wherein

L are identical or different and are each a π ligand or electron donor,

n is equal to 1, 2, 3, or 4,

M is a metal atom of group IIIb, IVb, Vb or VIb of the Periodic Table of the Elements,

X is a heteroatom or a hydrocarbon group having 1-40 carbon atoms,

X' is a hydrocarbon group having 1-40 carbon atoms,

with the proviso that at least on L is a substituted or unsubstituted indenyl.

50. The transition metal compound as claimed in claim 49, wherein the radicals L are linked to one another via a bridge.

51. The transition metal compound as claimed in claim 49, wherein n is 2 when M is a metal atom of group IVb of the Periodic Table of the Elements.

52. The transition metal compound as claimed in claim 49, wherein

M is a metal atom of group IVb of the Periodic Table of the Elements, n is equal to 2, where two radicals L are optionally linked to one another via a bridge Z and

Z is CR^2R^3 or SiR^2R^3 or a unit $Si-(CR^2R^3)_x-Si$ which links two fragments $L_uM^tXX'A-R^1_m$ with one another, where x is an integer from 0 to 10,

R^2 and R^3 are identical or different and are each a hydrogen atom, a halogen atom, a C_1-C_{20}-alkyl group, a C_1-C_{10}-fluoralkyl group, a C_1-C_{10}-alkoxy group, a C_6-C_{14}-aryl group, a C_6-C_{10}-fluoroaryl group, a C_6-C_{10}-aryloxy group, a C_2-C_{10}-alkenyl group, a C_7-C_{40}-arylalkyl group, a C_7-C_{40}-alkylaryl group, a C_8-C_{40}-arylalkenyl group, or R^2 and R^3 together with the atoms connected them form one or more rings, and R^2 and R^3 are optionally bonded to L.

53. The transition metal compound as claimed in claim 49, wherein

M is zirconium,

n is 2,

where two radicals L are linked to one another via a bridge Z, wherein

Z is CR^2R^3 or SiR^2R^3 and

R^2 and R^3 are identical or different and are each a hydrogen atom, a halogen atom, a C_1-C_{20}-alkyl group, a C_1-C_{10}-fluoralkyl group, a C_1-C_{10}-alkoxy group, a C_6-C_{14}-aryl group, a C_6-C_{10}-

fluoroaryl group, a C_6-C_{10}-aryloxy group, a C_2-C_{10}-alkenyl group, a C_7-C_{40}-arylalkyl group, a C_7-C_{40}-alkylaryl group, a C_8-C_{40}-arylalkenyl group, or R^2 and R^3 together with the atoms connected them form one or more rings, and R^2 and R^3 are optionally bonded to L.